

FIG. 1. Highly magnified actinomycotic colony showing gram positive centre and eosinophile clubs at the periphery. The individual filaments cannot be identified in the mycelial felt work (× 1,000). (From a section kindly given me by Professor Newcomb.)

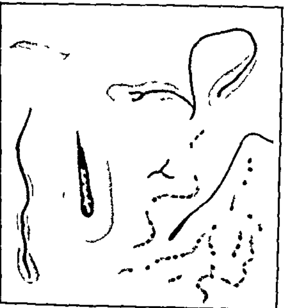


FIG. 2. Actinomycotic filaments and clubs stained by Gram's method and counter stained. (After Crookshank, *Medico-Chirurgical Transactions*, Vol. LXXII, Plate IV, Fig. 2.)

WHAT THE GENERAL PRACTITIONER OUGHT TO KNOW ABOUT

HUMAN ACTINOMYCOSIS

by

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DEDICATED TO THE STUDENTS OF
ST MARY'S HOSPITAL WITH WHOM I
SPENT SO MANY HAPPY YEARS

PREFACE

FROM the beginning of my clinical career I have been specially interested in actinomycosis as testimony of which the reader may be interested to know that the photograph on p 59 was taken by me when I was a surgical dresser When in active practice I was fortunate in seeing a considerable number of patients affected with the disease and found that current descriptions were often insufficient or misleading The first monograph on the subject in the English language was published in 1938 by the Oxford Medical Press this was meant chiefly for surgeons It is also important however that the present state of our knowledge on this disease should be known by every general practitioner and for this purpose I have put the chief facts within small compass so that they may be easily comprehended In lecturing to students on the subject I have found that some of the facts were more easily remembered if emphasized by simple rhymes I have therefore included a few of these which can easily be skipped by those who dislike this form of teaching

I wish to express my gratitude to the Oxford Medical Press for their great generosity in allowing me to make free use of the many illustrations which had appeared in the earlier volume and for the use of the blocks I would also thank the editors of the *Annals of the Royal College of Surgeons* and of the *British Journal of Bone and Joint Surgery* for permission to use illustrations which have appeared in those journals

V ZACHARY COPE

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WHAT THE PRACTITIONER OUGHT TO KNOW ABOUT

HUMAN ACTINOMYCOSIS

DISCOVERY OF THE FUNGUS

The tale of the fungus in Germany starts—
Discovered by Bollinger christened by Harz
Who noted the hyphæ grew out like sun rays
And knowing some Greek as they did in those days
(You know how the Greek derivation entices)
He called it ray fungus that's ACTINOMYCES
Though Ponfick gained credit as first of those seeing
The fungus obtained from diseased human being
'Twas Israel's graphic and accurate pen
Gave details of how the disease affects men—
An account of such value that even to day
One can read it with profit I venture to say—
And finally Wolff did a fine service when
He successfully cultured the true pathogen
And showed by his work done with very great care
That the delicate fungus would not grow in air

IN the year 1876 Bollinger a pathologist at Munich while investigating the purulent discharge from a lesion in the jaw of a cow detected a micro organism which he showed to his botanical colleague Harz the latter found that around a feltwork of hyphæ there was a series of radiating filaments and he therefore christened the organism ACTINOMYCES a word formed from two Greek words meaning ray and fungus

The next year Bollinger published an account of the condition and from that time the word actinomyces has

been used to denote the whole group of organisms which belonged that found in the jaw of the cow commonly the label *Actinomyces bovis* is attached to particular type found in the cow by Bollinger The ACTINOMYCOSIS has gained currency as the name o



Fig 1 O Bollinger
(From Pagel's *Biographisches Lexikon*)

pathological condition caused by actinomyces almost synonymous term streptothrix is now seld used

It is true that some previous observers had recorded accounts which most likely referred to the same organism but there is no doubt that Bollinger deserves the cre of being the first to draw serious attention to the disea

In 1879 Ponfick found a similar organism in a hum patient and from that time knowledge of the dis grew rapidly till in 1885 Israel published a clinical stu

of actinomycosis which was so accurate that few essential details have since been added.

The first man who tried to cultivate the common pathological organism (Bostroem) came erroneously to the conclusion that it was an aerobic type of fungus, but in 1890 Wolff showed that the organism which causes disease in man and animals (which he termed *Actinomyces bovis*) was anaerobic, and this fact has been amply confirmed by later investigators.

The committee of the American Society of Bacteriologists define the actinomycetes as "An organism growing in the form of a much branched mycelium which may break up into segments that function as conidia. Sometimes parasitic with clubbed ends of radiating threads conspicuous in lesions in animal body. Some species are micro-aerophilic or anaerobic. Non-motile. Type species *Actinomycosis bovis*." This general description is intended to include all the many varieties—pathogenic and non-pathogenic.

TYPES OF FUNGUS

Two types of fungus you must recognize
To this disease as likely to give rise;
The one with oxygen will freely grow,
The other looks on oxygen as foe.

The common fungus which affects mankind
Is almost anaerobic you will find;
Outside the body if it chance to dry,
The odds are long that it will quickly die.

It differs from the aerobic form
Which grows quite freely in the cold or warm,
And being saprophytic may with ease
Mask the less hardy cause of the disease.

For clinical purposes only two main groups need to be recognized. The first is a very large group comprising all those forms which grow in the natural state in soil or on vegetable matter: these are so common that if agar plates be inoculated with soil it will be found that 60 per cent of the resulting colonies belong to the aerobic form of actinomyces. They form a hardy race growing

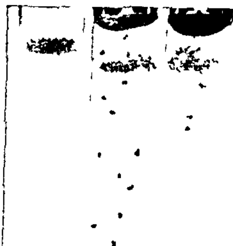


Fig. 2. Cultures of actinomyces in glucose agar showing maximum growth at [illegible] ¼ inch [illegible] surface. (Homer Wright.)

easily and quickly at room temperatures on all ordinary media and exposed to the normal atmosphere. Very few of this large group are pathogenic and they cause but a very small proportion of the clinical cases in human beings.

The second and much smaller group, which is preferably anaerobic or micro-aerophilic, is that which is responsible for most clinical cases of actinomycosis. It is known as *Actinomyces bovis* (Wolff-Israel). *This type has never yet*

been found outside an animal body As referred to above the fact that it is difficult to culture and that the common non pathogenic type grows very readily led the first investigator (Bostroem) to conclude that the latter type which occurs commonly in nature was the pathogenic organism in human lesions This error persisted and was copied into many text books The work of Wolff Homer Wright Naeslund Colebrook and others has however quite conclusively proved that human (and animal)



FIG 3 Micro-photograph showing growth of a colony of actinomyces in artificial media—sugar suspension culture (Homer Wright)

actinomycosis is almost always due to the delicate micro aerophilic organism which is so difficult to culture

The story which was at one time current that infection often occurred from the sucking of straws on which the organism might be parasitic owes its origin to the mistake of the initial investigator

The common pathological organism—*Actinomyces bovis*—is a monocellular mycelium which has delicate hyphæ from 0 5 to 1 micron across It shows true branching and seldom runs straight for more than 20 to 30 microns It is Gram positive but sometimes takes the stain rather irregularly

Though *Actinomyces bovis* is preferentially anaerobic yet after sub-culturing it will sometimes grow in the presence of oxygen though it will never thrive in that medium

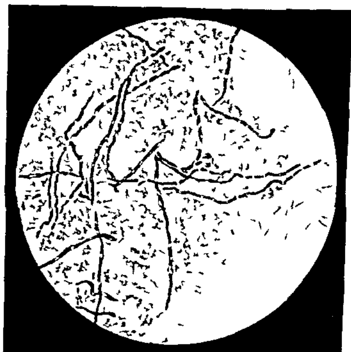


Fig 4 Micro-photograph of crushed actinomycotic granule showing mycelium surrounded by closely packed masses of *B actinomycetem comitans* (Colebrook)

It is killed by exposure to a temperature of 66° C for an hour and does not stand drying well

There is a small coccus which is frequently found in actinomycotic lesions so frequently that some have thought it might have some symbiotic significance but its true relation to the disease is not understood The

name given to this coccus is *Bacterium actinomycetum comitans*

Though most of the aerobic actinomyces are saprophytic and not as a rule pathogenic to man or animals yet there is a small group which is definitely pathogenic e g *A asteroides* and *A Eppinger*

Several investigators have tried to find a reliable blood test for the actinomyces but neither the fixation of the complement the agglutinating power the opsonic index the cutaneous reaction nor the precipitin test have been found to be reliable in the diagnosis of infection with the actinomyces

THE TISSUE REACTION TO THE ACTINOMYCES

When the actinomyces penetrates to the submucous or subcutaneous tissues it may at once set up an inflammatory reaction or it may for a time remain latent This latency is a curious feature of the disease The organism may remain latent for days or weeks or even months before signs of the disease appear In the same way disease which has been very active may under appropriate treatment apparently be cured but in reality be merely dormant and may wake up again after a considerable lapse of time

Reaction of the tissues varies much
Sometimes dense fibrous tissue formed is such
That like hard wood the swelling seems to be
With simulation of malignancy
At other times one finds close imitation
Of softer forms of septic inflammation

But soon or late a softening takes place
And sinuses will form in every case
While in the pus by your clear vision keen
The sulphur yellow granules will be seen

Now since the fungus cannot live in air
Do not expect to find an ulcer there
For surface epithelium heals again
While the disease spreads on a deeper plane

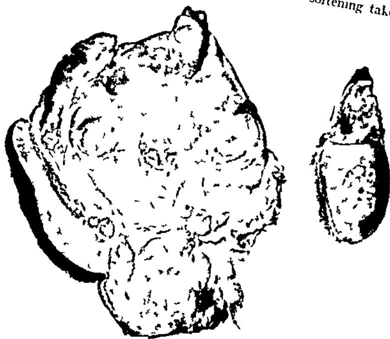
The tissue reaction is occasionally acute and may resemble that caused by septic organisms leading to the formation of what may appear to be a simple septic abscess. More often the reaction is subacute or chronic with the formation of a great amount of fibrous tissue and only a small amount of pus. The pus forms round small masses of mycelium which form the so-called sulphur yellow granules—the drusen of German authors. These granules may be as large as a canary seed or so small as scarcely to be visible to the naked eye. The colour of the larger granules is often of a mustard yellow but may be white pinkish grey or even black.

The cellular reaction varies from a soft gelatinous *granulation tissue to a hard fibrous tissue resembling* gristle. The soft granulation tissue is seen in acute cases and in the later stages of the more chronic cases. It is seen characteristically in the lesion of pulmonary actinomycosis when the disease has reached the surface as a pointing abscess; on opening the fluctuating mass one sometimes meets with a soft very vascular gelatinous mass bespeckled with yellow granules which look like scattered canary seeds. When, as is more common, the fibrous tissue predominates the lesion takes the form of a wooden hard, sometimes almost stony hard, mass which clinically resembles a hard scirrhus or fibro-sarcoma. The tissue is greyish white on section and shows here and there a blood vessel which cannot easily retract owing to the dense tissue around it.

Often no pus can be seen and sometimes many microscopical sections need to be examined before the true

nature of the condition can be determined The term Actinomycoma is sometimes applied to a well localized mass of this nature

When usually after a month or two softening takes



flexion at the corresponding hip joint while trismus results when the masseter is similarly affected

MICROSCOPICAL APPEARANCE OF THE LESIONS

The typical actinomycotic lesion consists of a centre composed of an agglomeration of the fungus and a periphery made up of the cellular response of the host. The central portion of fungus is made up of interwoven mycelial elements which stain well by Gram's method and a surrounding row of club shaped elements or processes which do not stain by Gram but take the counter stain well. These clubs are most likely mycelial terminations *modified by contact with the surrounding tissue*. In some cases the clubs may be absent and Naeslund noted that absence of clubs coincided with a rapidly extending pathological process.

Immediately surrounding each mycelial focus will be found a collection of round cells made up of polynuclear and mononuclear leucocytes. Outside this will be found a zone of *histiocytes* and *still further away fibroblasts* and then well formed fibrous tissue. The amount of fibrous tissue may be so great that microscopical sections may sometimes be mistaken for fibrosarcoma even by skilled pathologists.

INCIDENCE AND ÆTIOLOGY

The common pathogenic actinomyces—*Actinomyces bovis*—frequently causes disease in cows and pigs and occasionally in horses, sheep and dogs.

In human beings it is not common but it is certainly not rare. The disease is widely diffused throughout the world and it is noteworthy that in some regions where it was formerly thought to be rare more careful investigation has shown that it is quite as common as elsewhere. Reports of cases have been reported from every continent. The number of deaths from the mycosis in England and

PLATE II

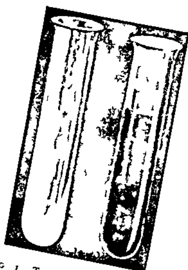


Fig 1 Test tubes containing respectively actinomycotic pus and pus mingled with blood In the first tube the granules can be seen adhering to the side of the glass in the second the lighter granules show up against the contrasted red of the blood

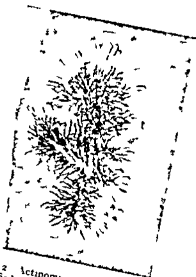


Fig 2 Actinomycotic colony magnified showing central network of filaments and surrounding palisade of clubs (From Med-Chirurgical Transactions Vol LXXII Plate III Fig 1 Drawn by Essex Wynter)

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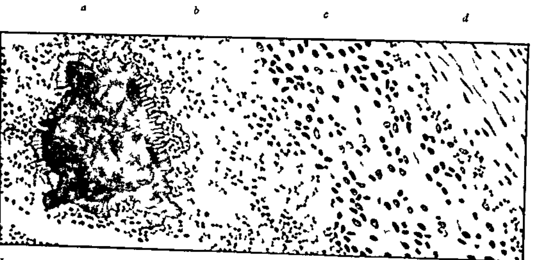


FIG. 3. Cellular reaction caused by actinomyces as shown in section kindly provided by Professor Newcomb.

(a) Colony of mycelium with well marked eosinophile clubs surrounded by pus in which polymorphs, monocytes and a few multinucleated cells are present.

(b) Young granulation tissue with a few polymorphs and many histiocytes. Many nuclei are undergoing karyorrhexis.

(c) Older organizing granulation tissue. No vessels happen to be in the field.

(d) Dense fibrous tissue.

Between (c) and (d) are many lymphocytes; this is an accidental finding and unusual. (× 200.)

Wales for the year 1949 was only 65 but it is likely that many cases of visceral actinomycosis may have been undiagnosed.

Age. Actinomycosis is a disease of adolescence and middle age. The majority of cases occur between the ages of 15 and 35. Less than 3 per cent of cases occur in children under the age of ten. Yet no age is exempt and even an infant has been infected. More men than women are affected in the proportion of two to one but it is not known why this is so.

When the erroneous view was held that infection usually came from vegetable matter it was assumed that agricultural pursuits were attended by a greater risk of acquiring the disease. We now know that there is no special reason why farmers or land workers should be more prone to infection than should those who dwell in towns. The small proportion of cases which are due to exogenous infection from grain or similar source is insignificant in relation to the majority due to infection with *Actinomyces bovis*.

Sometimes a small portion of straw or similar vegetable substance has been found in actinomycotic lesions and the part which such material plays in provoking infection has been much discussed. Consideration of all the known facts makes it likely that its chief role is to furnish the slight injury of the mucosa which is necessary for the anaerobic fungus to reach the subjacent tissues where it may have an opportunity to grow and develop. Naeslund also showed experimentally that the presence of vegetable matter helped the fungus to remain alive in the tissues for a longer period than would otherwise be possible.

Secondary Infection

Very frequently the actinomyces is accompanied by other organisms which may help to spread the disease

Staphylococci streptococci and diphtheroids may be present especially when there are sinuses which communicate with the surface of the body Klinger and later Colebrook found that there was frequently present in actinomycotic lesions a small coccus which they termed *Bacterium actinomycetum comitans* It is however doubtful whether this organism is of any ætiological significance (Naeslund) (See Fig 4 page 6)

Nevertheless the fact that the *Bacterium actinomycetum comitans* is only found in association with the *Actinomyces bovis* may be of considerable importance in diagnosis as was shown in the account of a case published by Kliber

> A carter aged 69 accidentally grazed his hand but the parts soon healed up Within a year however the back of the affected hand (left) developed a diffuse ill defined hard swelling with a few pustules on it There were no lymph glands palpable and the Wassermann reaction was negative More than eighteen months later the affected area was larger so the parts were scraped and cultures taken a pure culture of *Bacterium actinomycetum comitans* was obtained Since this microbe only exists in connection with the actinomyces search was made for the fungus in pustules and tissue sections at first this failed to show the fungus but when serial sections were taken it was discovered The granulomatous area was scraped away and potassium iodide given and recovery followed

HOW DOES INFECTION TAKE PLACE?

We have stated above that the common infection is that of *Actinomyces bovis* which has never been found outside an animal body How then does the infection reach human beings?

It is difficult to determine whether there is any

relationship between the frequency of the disease in cattle and that in man or if the infection be contagious between cattle and men. Certainly the number of recorded cases in which there was a probability of infection from animal to man is very small indeed.

It is known that the *Actinomyces bovis* often resides within the crevices of carious teeth or in the crypts of the tonsil in apparently healthy persons and the only way in which the organism can be transferred from one person to another must be by a *direct* or *indirect* method.

Direct infection from one human being to another is very rare, in fact only one case has been published in which such a transference has been claimed. This was the famous case recorded by Baracz who treated a man for actinomycosis of the left side of the mandible and five months later was called upon to treat the man's fiancee for a similar condition—actinomycosis of the mandible.

We must therefore fall back upon the method of indirect contagion to account for the transmission of the organism from one person to another. Since the organism is delicate and soon dies when dried it is clear that no long time can elapse between its residence in the infecting person and in the person to whom the organism is transferred. Countless opportunities for such a transference must occur. It is exceedingly common for two or more persons to drink out of the same cup without any adequate intermediate sterilization of the cup and one cannot wonder that the organism is often a resident in the oral cavity.

How does the actinomyces reach the part of the body where it develops?

The actinomycotic germ has never up to date been found outside the body in a live or growing state.

It often lives within the crevices of teeth decayed
And lies in wait until an opportunity is made
For it to gain those deeper parts wherein it grows
so well
That surgeons find it very hard its ravages to quell

Eruption of a wisdom tooth may give the germ a
chance
Or possibly just off a tooth the dental drill may
glance
The mucous membrane oft is torn though skilled be
the extraction
And this raw surface to the germ is ever an attraction

As might be expected more than half the total number of cases of actinomycosis occur in the region of the face and neck For the disease to get a hold in the tissues it is necessary for the mucosa in some way to be injured for the fungus cannot penetrate a normal mucosa The commonest opportunity for this to occur is after the extraction of a tooth and very many cases follow such an event A slip of the dentist s drill has been known to provide the necessary opening in the mucosa and the disease has on occasion developed directly after removal of the tonsil When a carious tooth has a hollow root the fungus may even obtain access to the interior tissue of the mandible and cause central osteomyelitis

The part which carious teeth play in transferring infection receives additional illustration from the fact that cases have been recorded (one by the author) in which the disease started in a part of the hand injured by contact with the teeth of an opponent in boxing

The actinomyces resident in carious teeth can get down to the stomach and intestines with swallowed food and can reach the air passages and lung by aspiration

Remember well this rather curious fact—
Oft piercing the alimentary tract
The fungus of its entry leaves no trace—
Search as you will you'll seldom find the place

Do not forget the usual tissue sites
Whereon the fungus commonly alights
The face the mandible the neck the tongue
The cæcal region liver skin and lung

Portions of the fungus must from time to time be swallowed and it is known that infection may emanate from various parts of the alimentary canal e g from the stomach appendix colon and the œsophagus A few cases have been recorded of actinomycosis of the stomach and quite a number have followed perforation of a peptic ulcer Perforation of an acutely inflamed appendix is a frequent precursor of an actinomycotic infection of the right iliac fossa

Infection of the thorax by the escape of the organism into the mediastinum through a perforation of the œsophagus certainly may occur and probably much more often that is commonly thought Infection may also occur via the respiratory tract On at least three occasions part or the whole of a carious tooth has been accidentally aspirated into the bronchial tree and has led to the formation of an actinomycotic abscess in the midst of a lung with the tooth in the centre of the abscess It requires little imagination to see that another possible method of infection may be the aspiration of small portions of the fungus into the lung

From any part of the abdominal part of the alimentary canal the fungus may travel to the liver by the portal venous factors

The skin may be infected in many ways It has occurred

at the site of a horse bite or in the place where the skin has been broken by a wooden splinter or other substance The skin is also secondarily infected when the disease works to the surface from a deeper primary focus

Sometimes generalized actinomycosis occurs by metastasis by the blood stream and metastatic cerebral abscess sometimes results from pulmonary infection

CLINICAL PATHOLOGY OF ACTINOMYCOSIS

The actinomyces attacks the tissues of the body in a way that is unparalleled by any other organism Though it can attack any part it is particularly prone to develop in connective tissue The lesion which it forms does not become so strictly circumscribed as a gumma nor has it the tendency towards ulceration that is seen with tuberculosis while it differs from both septic and tuberculous infection in its slight involvement of the lymphatic system

METHOD OF SPREAD

The process spreads by contiguity
Attacking planes in continuity
Sometimes it travels via the blood stream
Though this indeed is rarer it would seem

On one small point I'd like to be emphatic –
It seldom travels by the paths lymphatic
So bear this interesting fact in mind—
Enlarged lymph glands you very seldom find

In subcutaneous submucous and sub peritoneal connective tissue the infection spreads widely underneath but not often through the epithelium or serous lining Even when it breaks through the skin and discharges some of its broken-down products on to the surface the opening does not persist but usually quickly heals while the active process *beneath the skin travels further along the fatty*

or connective tissue layer Muscles are pushed aside or more frequently infiltrated Nerves may or may not be

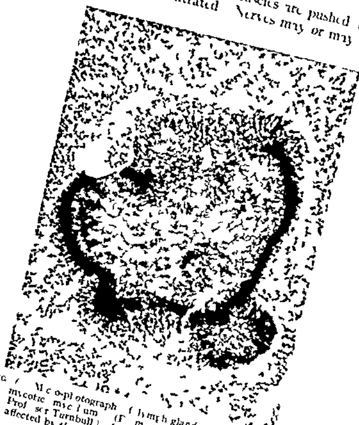


Fig [illegible] Microphotograph of lymph gland showing a tiny mycotic mycelium (From a slide kindly given by Professor Turnbull) It is rare for lymph gland to be affected by the actinomyces

irritated by the process Bones may be superficially eroded and in the case of the mandible or vertebra may be interstitially affected

The lymphatic system is relatively immune to attack

but several cases are on record in which the fungus lodged in glands and caused their enlargement A micro photograph of a focus in a lymph gland is shown in the *accompanying illustration* which was made *from* a microscopic slide kindly given me by Professor Turnbull

Sometimes after extraction of teeth an actinomycotic abscess has within a few days developed in the lower part of the neck without any evidence of involvement of the intervening tissues in these cases it is reasonable to suppose that portions of the fungus travelled by the lymphatics without developing within them until the lower part of the neck was reached There should be no difficulty in this for living elements of the fungus have been known to develop within a leucocyte which would have no difficulty in traversing the lymphatic channel

The peritoneum is resistant to attack large masses of diseased tissue may form behind the peritoneal membrane and bulge forward into the cavity without perforating the membrane This retro peritoneal extension may on occasion reach upward to the diaphragm medially to the vertebral bodies and downward into the pelvic cavity

In the subcutaneous tissue of the neck an actinomycotic focus may slowly emigrate from the submaxillary region down to the lower cervical region the original focus softens discharges through the skin and the sinus heals while the deeper focus extends subcutaneously to break out again lower down the neck In this way a series of puckered scars is formed down the side of the neck and a very characteristic picture results

Regional Incidence of Actinomycosis Over half the cases of actinomycosis occur in the region of the face and neck (cervico facial) just over a fifth are found in the abdomen just under a fifth within the thorax and the remaining lesions are found in the skin and other parts

CERVICO FACIAL ACTINOMYCOSIS

The face the mandible and the neck are by far the commonest sites for actinomycosis as might well be expected in view of the fact that the actinomyces is often a resident in the mouth A glance at the accompanying diagrams showing vertical and horizontal sections through the cheek indicates how easy is the path for an organism gaining lodgment in the mucosa of the gum to spread out into the tissues of the cheek

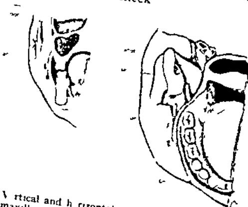


Fig Vertical and horizontal sections through cheek and lower maxilla regions to show relations of lower molar teeth to cheek (J E Frazer)

The Acute Form There is nothing characteristic about the acute type of inflammation which may take the guise of a gumboil or start like a submaxillary angina Softening soon occurs and an abscess forms and may be opened under the impression that it is a septic abscess In the pus one may find granules but more likely one would find numerous filaments of the fungus without any definite granules Spontaneous cure may follow drainage and the diagnosis may be at fault unless the pus be examined microscopically

The Subacute or Chronic Form of Facial Actinomycosis
This is far the most common lesion to be seen. It may come on without any known injury to the mucosa of the mouth, but it frequently follows a dental extraction, sometimes is the sequel to the eruption of a molar tooth



Fig. 8. Actinomycosis (parotid region)

through the gum, and may follow any accidental injury to the mucosa. The infection when arising from a carious tooth occurs in the submucous tissue of the gum, and in other cases may gain lodgment in the tonsillar tissues. From there the infection spreads out into the tissues of the cheek. The onset is insidious, and is characterized by a swelling of the face which has its maximum over a

the mandible but extends down into the submaxillary region and upwards towards the parotid gland. The masseter may be infiltrated and trismus commonly results. Pain may be present but is often minimal.

The consistency of the swelling is firm and elastic but



Fig. [illegible] Actinomycosis of parotid region (side view)

is sometimes wooden hard. With the finger in the mouth one can usually make out that the major part of the swelling is superficial or lateral to the body of the mandible and frequently the firm anterior edge of the hard diseased area can be felt by the palpating finger.

Trismus, or inability to open the mouth, may be an

early symptom and may persist throughout the course of the disease. Even when all the inflammatory infiltration appears to have gone the patient may still complain that the jaws feel stiff.

Though the swelling is usually painless to the touch, in some instances there is a complaint of neuralgic pain which is likely to be attributed to the carious teeth which

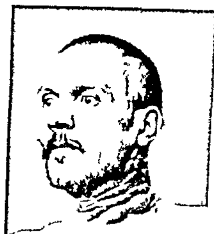


Fig. [illegible].—Showing puckered scars due to cervical actinomycosis. (After Illich.)

are often present. The facial swelling may persist for weeks or a month or two before softening occurs; the softening most often takes place over the angle of the jaw, or more rarely in the infra-orbital region. The pus which escapes on incision usually contains the characteristic granules.

The further course of the disease varies. Sometimes under treatment the swelling rapidly softens and subside

as the pus discharges from the sinuses. Often the facial swelling subsides but the inflammation creeps down the neck breaking out and healing so as to leave the series of puckered scars mentioned above and illustrated in Fig 10. Rarely the disease extends upwards, may enter the pterygoid region and even penetrate to the interior of the skull through one of the basal foramina.

In some instances the lesion remains more localized and forms a small submaxillary swelling which breaks down to form a subacute abscess resembling a cold abscess except that it is slightly tender and contains fragments of the fungus in the pus.

INFECTION OF THE SALIVARY GLANDS

The salivary glands may be infected via their ducts particularly the submaxillary. The infection may break through the gland capsule and the inflammation spread to the submaxillary cellular tissue. Soderlund has demonstrated that some salivary calculi are formed by a deposit of insoluble salts on a basis of actinomycotic mycelium.

ACTINOMYCOTIC INFECTION OF THE LOWER JAW

Since infection commonly comes from carious teeth it is no wonder that the actinomyces fairly often attacks the mandible; indeed it is surprising that it is not always affected for the inflammation is always contiguous to the bone in facial cases.

The mandible may be affected in three ways.

1 **A Periostitis.** A periostitis may be set up as a consequence of the neighbouring inflammation. This may lead to the formation of a layer of new bone on the external plate of the mandible. This is of slight significance.

2 **Actinomycotic Osteomyelitis.** This is not so common but is the nearest approach in human beings to the large

tumour like bony swelling seen in the jaws of cows and horses (see Fig 5) The lower jaw becomes greatly thickened by interstitial and periosteal formation of new bone through which course narrow tracks or sinuses which are lined by granulation tissue and contain pus in which will be found granules of the fungus These tracks may riddle the bone in all directions In a few



Fig 11 X-ray photo of actinomycotic mandible showing sequestrum and abscess cavity (Author's patient)

cases the destruction of bone may be greater than the new formation and then (as in the illustration) sequestra may form (Fig 11)

3 **Central Rarefying Osteitis** The infection may gain access to the interior of the mandible through or by the side of a carious tooth It may then set up a local osteomyelitis which may result in the fungus working its way through the bone to the surface where it may form a submaxillary abscess

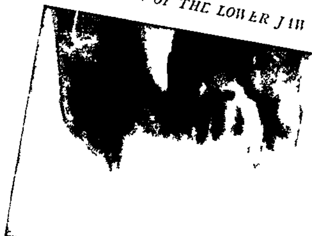


FIG 12 Narrow tube of new bone along the track of a mandibular focus which burst into the submaxillary region (Courtesy of the Journal of Bone and Joint Surgery E & S Livingstone Ltd)

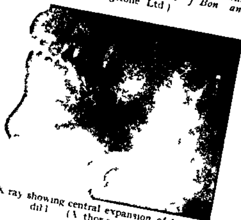


FIG 13 X ray showing central expansion of left side mandible (Author's patient)

Such was the case in the patient whose mandibular radiograph is here shown Infection followed the stop

ping of some carious teeth In the lower part of the mandible can be seen denser bone where the focus of actinomycosis was situated the inflammation worked outwards and a small tube of newly formed bone indicates where it escaped from the bone A small deep abscess was opened by the writer and *Actinomyces bovis* recovered from the pus (Fig 12)

If it does not succeed in escaping from the bone it may cause a gradual expansion of the mandible so that a cyst like cavity is formed in the cavity will be found actinomycotic pus

A girl of 16 was seen for a swelling of the left side of the lower jaw which had been increasing in size for the last twelve months more rapidly just lately The swelling projected from the outer aspect of the horizontal ramus from the position of the canine to the second lower molar tooth The second bicuspid and first molar tooth in relation to the upper part of the swelling were carious and only the stumps remained The skin was free and the tumour felt hard so that at first a new growth was suspected An X ray examination showed a more rarefied centre to the swelling At operation on clearing the periosteum from the bone pus containing typical actinomycotic granules escaped from the interior of the jaw *The carious stumps were removed and a* probe passed direct from the sockets of the extracted teeth into the abscess cavity The wall of the cavity gave egg shell crackling on pressure This case demonstrated well the direct connection of carious *teeth with an actinomycotic infection*

ORBITAL ACTINOMYCOSIS

Sometimes though rarely actinomycosis find it way from the soft parts of the face deeply through the tem

PLATE III





Actinomycosis of the tongue. The lesion was in the anterior part of the tongue near the tip and formed an irregular ulcer. It was successfully excised by Mr H W Williams to whom I am indebted for the notes of the case and access to the specimen.

(The specimen was removed from a healthy farmer aged forty-five. Three weeks' history of roughness on the right side of the tongue, painful for one week. Teeth sound. Lesion the size of a shilling resembling a chronic carbuncle. Treated by excision of the area. Gram positive actinomyces fungus identified in the section. One year later there was no sign of recurrence.)

[illegible]

poral fossa and the spheno maxillary fissure into the orbit Most of the inflammatory material then forms behind the eyeball so that the main feature is a gradually increasing exophthalmos usually without any impairment of vision

ACTINOMYCOSIS OF THE LACHRYMAL CANALS

The actinomyces is a common inhabitant of the conjunctival sac and may lodge in the lachrymal canal and cause inflammation It does not seem to affect the lachrymal sac or duct

When the canal is affected (nearly always the lower) there is irritation of the inner angle of the conjunctival sac and a swelling about the size of a pea in the region of the lower lachrymal canal Pus containing the organism can be expressed from the canal

PARA LARYNGEAL ACTINOMYCOSIS

Sometimes the disease makes its appearance primarily lower down the neck in the region of the larynx In these cases infection has taken place either through the mucosa of the pharynx or the fungus may have been transported from the buccal region possibly by the lymphatics without causing any intermediate lesion

Para laryngeal actinomycosis appears as a hard nodule to one or other side of the larynx and may extend as far down as the clavicle Sometimes the thyroid cartilage may be involved and in these cases there is the likelihood that the condition may be mistaken for malignant disease

ACTINOMYCOSIS OF THE TONGUE

Since the tongue is adjacent to carious teeth in which the fungus may be latent one would expect actinomycosis of the tongue to be common whereas it is one of the rarer places in which it develops In those few cases in which it is attacked the affected part has usually been the

lateral margin near the tip The lesion commonly takes the form of a small hard nodule very slightly or not at all painful but occasionally there is a more extensive infiltration An abscess may form and discharge pus and leave a sinus The acute type of actinomycotic inflam-



Fig 14 Photograph of actinomycosis of tongue (From New and Figi Amer Jour of Med Sci)

mation of the tongue may easily be mistaken for a septic abscess or a gumma the hard nodule may closely simulate a carcinoma or hyperplastic tuberculosis In cases of doubt excision of the nodule and microscopic examination may be necessary

ACTINO BACILLOSIS OF THE TONGUE

In many text books it is still stated that the wooden tongue of cattle is caused by actinomycosis This is not correct The common wooden tongue of cattle is caused by a bacillus and the condition is an actino bacillosis The actinomyces takes no part in its causation It is important to remember this for while potassium iodide is a specific treatment for actino-bacillosis it is by no means a specific for infection by the actinomyces

The bacillus which causes wooden tongue in cattle is Gram negative It may form small granules but the centre of the nodule is Gram negative Actino bacillosis is accompanied by enlargement of the lymph glands

At least three cases have been recorded of actino bacillosis in human beings

In another place we give some general remarks on the diagnosis of actinomycosis (see p 60) Since the facial region is the commonest site for an actinomycotic lesion we think it well to enumerate the conditions from which this form of the disease needs to be distinguished

Simple subcutaneous abscess of pyogenic origin This is more painful examination of the pus serves to distinguish

Septic Periostitis and Alveolar Abscess Here again there is greater pain Carious teeth may be associated with both conditions and microscopic examination of the pus is the only way to differentiate

Parotitis and Submaxillaritis The usual area involved in cervico facial actinomycosis extends over both parotid and submaxillary regions but if infection enters the duct of either gland the inflammation may be confined to the region of one or other gland The examination of the discharge from the duct of the gland may clear up the diagnosis

Necrosis of the Jaw This condition whether due to septic compound fracture syphilis acute osteomyelitis tuberculosis or other cause leads to the formation of a swelling like that produced by actinomycosis Occasionally actinomycosis may cause necrosis and sequestrum formation but this is comparatively rare

In distinguishing between them the history helps much and a good X ray photograph more It is noteworthy that with ordinary forms of necrosis of the jaw sinuses

discharging pus are quite as likely to form on the inside of the mouth as on the exterior while with actinomycosis it is rare for discharge to drain into the mouth. Bare bone may be felt at the bottom of a sinus in the case of septic necrosis but seldom with actinomycosis.

Cysts of the Lower Jaw. The rarefying form of actinomycosis may so expand the mandible as to form a large cystic space indistinguishable at first sight from a dental cyst. Both conditions may be associated with carious teeth. A simple cyst is perhaps more commonly seen in the upper jaw while actinomycosis usually affects the lower jaw in the molar region.

The only certain way of differentiating is to remove some of the fluid from the cyst and examine it microscopically. A radiograph would detect an unerupted tooth in a dentigerous cyst.

Tuberculosis of the Lower Jaw. This is very uncommon in the region of the angle of the mandible. Small sequestra often form and are extruded from the sinuses. The pus from the sinuses does not contain granules of actinomyces. An X-ray photo would show that rarefaction and indistinctness of outline which is usually associated with bony tuberculosis.

An impacted wisdom tooth may cause difficulty in diagnosis. An unimpacted wisdom may cause considerable swelling and there is always the possibility that the actinomyces may gain access to the cellular tissues through the abrasion caused by the erupting wisdom tooth. The two conditions are sometimes confused for a time; ultimately when softening has occurred the characteristic pus would give the clue.

Sarcoma. It may be impossible to distinguish the early stage of a fibro-sarcoma from a small nodule of actinomycosis. A sarcoma should have more defined borders and stand out more prominently from the jaw

It causes a symmetrical swelling on both the inner and outer aspects of the mandible while actinomycosis affects chiefly the outer part of the bone and seldom encroaches

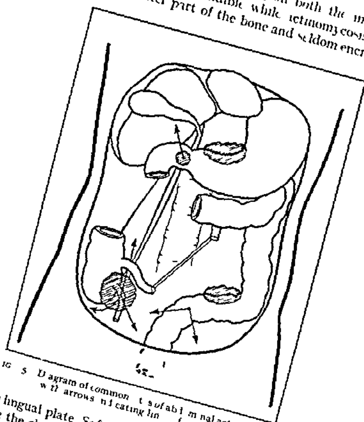


Fig. 5. Diagram of common sites of abdominal actinomycosis with arrows indicating lines of extension

on the lingual plate. Softening will ultimately bring to the surface the characteristic pus.

An osteoclastoma develops more slowly than actinomycosis, does not cause infiltration of the cheek till late, and the X-ray appearances of the two conditions are very different.

ABDOMINAL ACTINOMYCOSIS

Now one of the vices
Of actinomyces
Is to scape from the gut
Through a hole or a cut
  And proceed thereupon to develop
Till it forms a big mass
Which is often alas!
First mistaken for growth
For it happens that both
  Are quite hard and the gut may envelop
It leaves not a trace
Of the actual place
  Where it happened to leave the intestine
But confuses the issue
By growing in tissue
  (Connective) it likes to grow best in

  The common site where it escapes
  Is where a perforation gapes
  Of an inflamed appendix—so
  The reason clear you now may know
Why the ray fungus is so often found
In cæcal region and the parts around

ACTINOMYCOSIS IN THE ABDOMINAL CAVITY

The abdomen is a comparatively frequent site for the development of actinomycosis about one fifth of all cases of the disease have the chief focus in this cavity

The fungus nearly always gains access to the abdomen by way of the alimentary tract but the solid organs may sometimes be reached via the blood stream Rarely if ever does the infection travel down from the thorax

cavity through the diaphragm but when the lower thoracic vertebrae are affected the disease may spread by contiguity to the upper lumbar vertebral bodies

THE STOMACH

Whenever the *Actinomyces bovis* is a resident in the mouth portions of the fungus must from time to time be swallowed and escaping through an abrasion of the



FIG 16 Actinomycosis of Duodenum (After Behring)

gastric mucosa may develop in the wall of the stomach several instances have been recorded in which the resulting inflammatory mass was so firm and fibrous that the condition was regarded by the surgeon as malignant and the true nature was only discovered after a careful microscopic examination had been carried out

The accompanying illustration is taken from the account of a case published by Behring

> A woman aged 67 had symptoms of pyloric stenosis. At operation the gall bladder which contained stones was adherent to the pylorus. Cholecystectomy was performed and examination of the pylorus and adjacent duodenum showed it to be enlarged and thickened with a consistency unlike that caused by ulcer or cancer. Partial gastrectomy was performed and examination of the specimen showed a minute ulcerated area in the duodenum leading down to an actinomycotic focus in the substance of the duodenal wall. (See Fig. 16.)

More common and perhaps of greater clinical interest is the development of an actinomycotic lesion outside the stomach following the perforation of a peptic ulcer. The usual history has been that a perforation which showed no unusual features was sewn up and the patient left hospital apparently well only to return some months later with an abdominal swelling which ultimately proved to be due to an actinomycotic lesion. In the case recorded by Keynes a year elapsed between the suture of the perforation and the return of the patient with an actinomycotic liver. In this patient at autopsy there was found a small abscess containing colonies of the fungus in the scar tissue underlying the site of the ulcer.

In the case recorded by Sir Gordon Gordon-Taylor a patient whose perforated ulcer had been sewn up returned three months later with a large pelvic mass which caused obstruction of the colon; this mass diminished under treatment by potassium iodide but two years later the patient needed to be operated upon for a hepatic abscess in which the actinomycotic fungus was found.

In these cases there can be no reasonable doubt that the actinomyces escaped from the stomach at the time of perforation and developed slowly in the same manner as

it does in the case of the much more common appendicular perforation

> Now when it attacks the abdomen or chest
> Actinomycosis may prove a hard quest
> For in the first stages it is a deceiver
> And may simply seem an unusual fever
> While later when definite signs may appear
> Once more diagnosis may not be too clear
> It may look like tubercle possibly growth
> And sometimes one even may diagnose both
> Yet quite a percentage of patients will die
> Without your quite knowing the how or the why
> Then autopsy shows the correct diagnosis
> Which had not been thought of—actinomycosis

ACTINOMYCOSIS OF THE INTESTINES

The actinomyces may escape from any part of the intestine and cause an inflammatory mass not so much in the wall of the intestine as in the mesentery adjacent to the bowel

Ileo cæcal actinomycosis is by far the most common form of intestinal actinomycosis The reason for this is clear in that the common occurrence of perforation of the appendix frequently gives the actinomyces the opportunity to escape from the bowel and form a granulomatous mass in the right iliac fossa

The common type is that which starts during the convalescence of an acute attack of perforative appendicitis The patient appears to be making good progress but if a drainage tube has been inserted the track does not close after the tube has been removed and the walls of the persisting sinus become indurated and the surrounding parts fixed The hard mass increases in size and there is usually irregular fever Ultimately and often after a

considerable time has elapsed granules of the fungus are obtained from the sinus.

The less common type is that which develops with or without a history of a previous attack of appendicitis and the first thing to be noted is the presence of a hard mass in the right iliac fossa, and this may be accompanied



FIG. 1.—X-ray of the thorax and abdomen after [illegible] sinus. (Sir H. [illegible] Oxford [illegible])

by flexion of the right hip. As a rule the mass in the right iliac fossa is painless.

In both these types the inflammatory infiltration may extend (chiefly retro-peritoneally) upwards towards the diaphragm, medially through the psoas in the direction of the vertebral column (which may thereafter be involved in the disease), or downward toward the pelvic cavity.

The way in which the actinomycotic process may extend is well shown by the accompanying radiograph, which was taken after the injection of lipiodol into a

sinus in the right iliac fossa of a patient under the care of Sir Heneage Ogilvie the opaque material was found to track upwards to the liver and through the liver into the bronchial tree

As the disease progresses the patient loses strength and becomes increasingly anæmic The hard mass may soften and abscesses form and burst in the loin or groin The rate of extension is slow and the disease may regress in

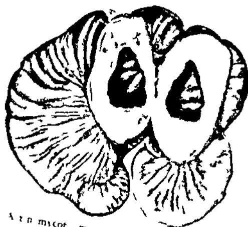


FIG. 8 Actinomycotic mass in mesentery of small intestine (Sir Gordon Taylor)

one place while it extends in another The kidney may be involved by contiguous infection or the liver by portal metastasis

Ileo cæcal actinomycosis needs to be differentiated from Crohn s disease from tuberculosis and from malignant disease Till recently the prognosis was very poor but since the discovery of the anti biotics the outlook has greatly improved Actinomycosis of the small bowel is rare but a very interesting instance was recorded by

Gordon Taylor who resected a segment of small gut for what appeared to be a malignant growth but proved on microscopic examination to be a large hard actinomycotic focus situated in the mesentery clo e to the bowel

ACTINOMYCOSIS OF THE COLON

This is a rarity and whenever it has occurred it has almost always been mistaken for a malignant growth It forms a hard mass which may involve the wall of the colon but for the most part grows outside the bowel Inasmuch as biopsy is generally impracticable it may be undesirable to await softening and the formation of pus and it is probably better that such tumours should be excised when practicable since the possibility of malignancy cannot be excluded at an early stage

ANO RECTAL ACTINOMYCOSIS

Between forty and fifty cases of ano rectal actinomycosis have been recorded In half the cases the disease appeared to have spread outwards from the bowel (primary) while in the other half there was reason to think that the inflammatory process had involved the rectum secondarily from a primary source within the pelvic cavity

The most characteri tic symptoms are seen in those instances in which infection has occurred from within the anal canal There is little or no evidence to show that infection ever has occurred through the anal skin

At first the subacute or chronic inflammatory mass clo e to the anus and rectum may cause irritation of the mucosa with some tenesmus or diarrhoea but later the mass softens abscesses form and sinuses or fistulæ develop in the parts around

Extension may take place upward and outward through the great sciatic notch into the buttock where a

gluteal abscess may need to be opened As a rule no opening into the bowel can be found and ulceration of the mucosa is rare In Gordon Taylor s case proctoscopic examination showed an inflamed mucosa in which small yellow granules of the fungus were seen shining through the oedematous mucosa

As an example of infection occurring in rather a curious manner we might refer to the account given by Risak of an actinomycotic focus which formed in the sacral region after the performance of an excision of the rectum leaving a permanent sacral anus and a blind anal canal The year after the resection the patient returned with a fistula below the sacral anus Operation was performed *to re tore the continuity of the rectum* The sacral anus was freed 12 cm of bowel resected and the proximal end joined to the anal canal Attached to the resected part near the outer opening was an adherent mass of hard ti sue 1½ cm by ½ cm in which the actinomyces with club formation was demonstrated In this case the probability is that infection occurred from the lumen of the bowel during the resection

ACTINOMYCOSIS OF THE KIDNEY

The kidneys may share in the general dissemination of the disease in actinomycotic pyaemia and may also be secondarily infected by extension from a neighbouring focus e g from an extending lesion in the right iliac fossa

In addition a number of cas s have been recorded in which the renal lesion has been the only detectable focus of the disease in the absence of other lesions these have been termed instances of primary renal actinomycosis but it is likely that here we may be dealing with a second ary infection in which the primary focus has disappeared

Though the actinomyces may cause a pyelonephritis and lead to a pyonephrosis it is more common for the

lesion to take the form of a chronic suppurative process closely simulating a renal carbuncle in microscopic appearance

The circumscribed lesion progresses slowly and may take months before it bursts through the renal capsule It is essentially a granulomatous condition with small purulent foci containing the fungus interspersed throughout it There is considerable fibrous tissue reaction and

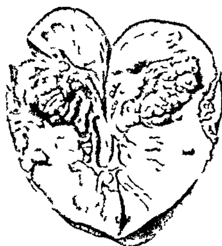


FIG 11 —Solitary actinomycosis of kidney (Israel)

it may need careful search to find the actinomyces Small deposits of calcium may occur and the kidney is usually densely adherent to the surrounding parts

The **symptoms** of renal actinomycosis are insidious and the general effect of the disease may be noted some time before the local renal condition is suspected Fever anaemia loss of appetite and weight and possibly rigor and sweats are the general symptoms while local pain tenderness and muscular rigidity are the main local

signs As the disease progresses a tumour may be felt A pyelogram may show a deformed renal pelvis Leucocytosis may reach 16 000 per cu mm

Diagnosis has to be made from other renal conditions and this necessitates a full urinary and radiographic examination If the actinomyces be found in the urine diagnosis is simplified but otherwise the most likely diagnosis to be made would be renal carbuncle and in the absence of perinephric suppuration and the formation of superficial abscesses containing the pus it is difficult to see how a certain diagnosis could be attainable before exploration

ACTINOMYCOSIS OF THE GENITAL TRACT

The male genitalia are seldom attacked by actinomycosis A primary lesion of the scrotal skin may occur and will not differ in its general characters from cutaneous lesions elsewhere A primary actinomycotic lesion of the corona glandis has been recorded and as might be expected it was mistaken for a primary chancre until the fungus was obtained from the pus

In the female the ovary and Fallopian tubes have frequently been involved The route of infection has probably in most cases been by extension from an ileocæcal focus of the disease but in a few instances it has been difficult to exclude infection spreading up the uterine canal

The disease may be limited to one ovary or tube or it may attack the adnexa of both sides The parametrium is commonly affected but the uterus itself but seldom In late cases the pelvic contents may be inextricably embedded in a mass of hard inflammatory material to which the intestines may be adherent The disease may run a very chronic course and sometimes remains latent for long periods

It is very rare for actinomycosis of the ovaries and tubes

to be diagnosed before the abdomen has been opened because there are no pathognomonic signs or symptoms The usual history is that of a chronic inflammation with lower abdominal pain and perhaps leucorrhœa The appendix may recently have been removed for either acute or chronic inflammation

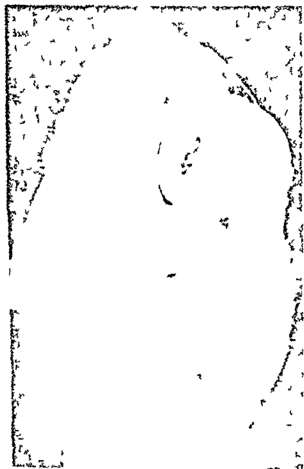
The main features will be irregular fever hypogastric pain perhaps night sweats and on pelvic examination a mass will be felt in the pouch of Douglas

Diagnosis may be made as the result of the examination of pus from an abscess which may come to the surface in the groin or buttock or which may bulge into the posterior vaginal cul de sac In other cases diagnosis will not be made before microscopical examination of a removed tube or ovary has been carried out

Diagnosis needs to be made from septic salpingo oophoritis and from tuberculous disease of the tubes or from the widely infiltrating type of malignant disease As a rule this can only be done by abdominal exploration

ACTINOMYCOSIS OF THE LIVER

Wherever in the abdomen the fungus starts to grow
It manages quite oft to reach the liver
Direct extension is the way it sometimes likes to go
More often by the portal venous river
Within the gland at first it forms large masses whitish grey
Like secondary growths to naked eye
Then softened areas appear and soon to you display
Big abscesses with many loculi —
The areas affected thus have often been compared
Unto the section of a honeycomb
Maybe but I am sure that no beekeeper would have dared
To label thus the busy bees sweet home



from the commonest primary site of abdominal actinomycosis (ileo cæcal) The liver is open to infection by four routes The most common mode of infection is via the radicles of the *portal vein from a focus originating* in the stomach appendix colon or rectum in these cases the inflammatory reaction is arranged around the portal branches in the liver

In addition the disease may reach the liver by contiguity from nearby viscera (e g the kidney or cæcum) or by lymphatic spread from another abdominal focus or by the blood stream in the hepatic artery From time to time cases of primary actinomycosis of the liver are recorded though termed *primary* these lesions must in fact be secondary to infection elsewhere

The pathological changes in the liver are slow in development At first the lesion is firm and fibrous with areas of compact granulation tissue separated by fibrous septa at this stage the macroscopic appearance may resemble malignant growth Soon however soft areas form and local collections of pus are limited by the fibrous partitions so that the appearance of a cross section is that of many small compartments *this* condition has been rather fancifully compared to a honeycomb

The affected part of the liver may become adherent to neighbouring viscera to the abdominal wall or to the diaphragm in some instances abscesses burst through the diaphragm into the lung or through the abdominal wall on to the surface of the body

The symptoms of hepatic actinomycosis will initially be those due to infection at *the primary site from which* infection reached the liver but in those cases in which the disease at the primary site gave few symptoms it may be the liver which first calls attention to the pathological condition



Fig. 1 Actinomycosis of liver with sinus through abdominal wall (R.C.S. Museum)

Irregular fever sweats and anæmia may be noted while locally there will be enlargement of one or both lobes of the liver. Sometimes irregular prominences

may be felt on the surface of the organ and this may give rise to a close simulation of a gummatous or malignant change An abscess in the abdominal wall may be the first indication of the deeper focus of disease

When the disease affects chiefly the upper part of the liver the diaphragm may be pushed upwards and the bulging of the muscle as revealed by a radiograph may give some indication of an impending rupture of an abscess into the lung

In most cases the diagnosis cannot be clinched until the abdomen has been opened and even then it may be necessary to excise a bit of the diseased hepatic tissue for microscopic examination When the hepatic lesion follows some time after another known actinomycotic lesion within the abdomen one may assume that there is a connection between the two condition

The gall bladder has on only one occasion been the site of an (apparently) primary actinomycosis

ACTINOMYCOSIS OF THE CHEST

The actinomyces as facts do attest
Quite often gets into and grows in the chest
Two routes it may take and from these there have
sprung
Two types—of the *mediastinum* and *lung*

The germ may be swallowed and then on occasion
May creep through an oesophageal abrasion
And into the mediastinum escape
To form a big mass of a tumour like shape
When the pus at length forms 'tween the ribs it will
track
So the abscess will point by the spine in the back
(Now in this special type very often one sees
That the lung may be totally free from disease)

From the mouth it may be that the fungus is fated
Deep down in the bronchi to be aspirated
Where aided perhaps by some local mischance
Within the lung tissue it then may advance
And sooner or later break through the chest wall
(Which is quite unlike tubercle you will recall)

In *both* of these types it should not to you seem a
Surprise if one finds there's a large empyema

Thoracic actinomycosis is the most serious form of the disease and in one seventh of the total number of cases this is the part affected The condition is frequently overlooked till late and every practitioner should have knowledge of the various forms of the disease

Infection may arise from aspiration of gross portions of infected material into the bronchi for example there are at least three instances on record in which a carious tooth has been accidentally aspirated into the lung and led to the development of an actinomycotic focus around the tooth It can easily be realized how the aspiration of small fragments of saliva or mucus into the lung may in a similar manner lead to the start of infection That this is quite common can be deduced from the remarkable fact that Kaye was able to isolate and culture the *Actinomyces bovis* from 65 out of [illegible]40 specimens removed from the bronchial tree by bronchoscopy in a series of patients suffering from pneumonitis and other pulmonary disorders It is clear therefore that the pathogenic germ is frequently present and only waits for opportunity to establish itself The wonder is that it succeeds so seldom

Some few cases of pulmonary infection are due to the aerobic type of actinomyces It is not difficult to imagine how particles of dust containing bits of the fungus could be inspired into the lung

Primary thoracic actinomycosis can and most likely does sometimes commence by the fungus penetrating the

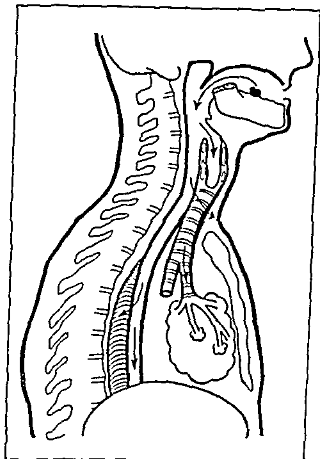


Fig. 2. Diagram indicating how actinomyces [illegible]

wall of the œsophagus and thus reaching the mediastinum. Cases have been recorded in which there has been a [illegible] or a depressed scar in the œsophagus showing the place

where infection may have entered the mediastinum but this is uncommon for as in the mouth the place of entry often heals up without leaving any observable trace

Of the two main types of thoracic actinomycosis—the pulmonary and the mediastinal—that in which the lung is primarily involved is more common but in both the disease may spread to the pleura and from that to the

Fig 23 Act n mycos s f hest which has b ok n th gh th par t s (B t J Surg J hn W ght & Son Ltd)

chest wall though parietal involvement comes sooner and more often in the mediastinal type

When the lung is primarily involved local consolidation occurs at the site of infection and in spite of great defensive tissue reaction the process always advances steadily and slowly till the major part of the affected lung is put out of action When the disease reaches the visceral pleura pleural effusion results this may at first be clear but soon becomes purulent The next stage is the

infiltration of the thoracic wall and the formation of a pointing empyema. The lower lobes of the lung are more prone to infection than the upper. The infiltration of the thoracic wall and the pointing of the empyema necessitatis usually takes place at the level of the attachment of the diaphragm.



Fig. 24. X-ray of chest with actinomycosis of lower lobe of right lung. (*Brit. J. Surg.*, John Wright & Sons, Ltd.)

Figs. 23 and 24 concern the following case:

B. K., a girl aged 13, had right-sided pleurisy in May 1914. This attack apparently subsided. Two months later she felt pain in the front of the right lower chest; a week later a cough developed, but there was no sputum. A fortnight after this a swelling was noted over the right lower chest in front. She was then admitted to hospital, where the swelling was noted to extend from the level of the third to the seventh costal cartilage; it was dull on percussion and tender to touch. The leucocyte count was 20,000. In August 1914 the patient came under

the writer's care. Incision of the swelling showed it to be composed of soft friable vascular tissue somewhat resembling a soft sarcoma and microscopy demonstrated some cells suggestive of a round-celled sarcoma. A month later however further exploration revealed the true nature of the mass to be actinomycotic granulation tissue. In spite of treatment by vaccines, potassium iodide and the local implantation of radium the patient gradually went downhill but no autopsy report is available.

The mediastinal form of thoracic actinomycosis probably starts as an infection from the œsophagus into the superior or posterior mediastinum. The close relationship of both pleural membranes to the mediastina may cause an early pleural effusion or empyema. The actinomycotic mass may form a large tumour which may easily simulate the radiographic appearance of a mass of glands or a malignant tumour. The inflammatory process tends to attack the heads of the adjacent ribs and the vertebral bodies which may be completely surrounded by the mass of diseased tissue. In some of the described cases the mediastinum has been filled with a densely hard inflammatory mass containing foci of softened material and pus and an empyema has been present, yet the lung has been free from disease even though the overlying visceral pleura has been studded with actinomycotic granules.

Mediastinal actinomycosis nearly always sooner or later leads to the formation of abscesses which point in the para vertebral region. General dissemination by the blood stream is peculiarly apt to occur with actinomycosis of the lung and cerebral abscess is one of the more common results. Extension by continuity of tissue may take the fungus into the pericardium or even into the very substance of the heart and similarly it may find its way into the vertebral column.

The late symptoms of either thoracic or abdominal actinomycosis may be accompanied by amyloid disease

SYMPTOMS OF THORACIC ACTINOMYCOSIS

At first the symptoms may be so slight that the patient does not notice them or consider them to be of sufficient importance to call for advice A slight cough a mild attack of bronchitis or a pain in the chest may at first be neglected But if the cough gets worse or if the patient begins to lose strength or if the pain gets more severe and breathlessness comes on then the doctor's advice may be sought

The physical signs will not be characteristic for actinomycosis may simulate almost any disease of the chest The signs may be those of consolidation of the base of the lung of pleural effusion of empyema almost pointing or even of gangrene of the lung Sooner or later will come the distinguishing sign of an abscess of the chest wall which on incision will give exit to pus containing the yellow granules

Mediastinal actinomycosis frequently forms abscesses which point in the back on one or other side of the vertebral column and may then track down toward the loin

The late stages of thoracic actinomycosis are accompanied by irregular fever night sweats wasting and anaemia and perhaps albuminuria and amyloid disease

Diagnosis Actinomycosis of the thorax is seldom or never diagnosed until the disease has become well established It is one of the causes of cryptogenic fever It is most often mistaken for tuberculosis or malignant disease Tuberculosis more often attacks the apex of the lung and never *bursts through the thoracic wall* actinomycosis more often involves the lower lobe of the lung and ultimately in nearly every case forms an abscess which bursts through the thoracic wall

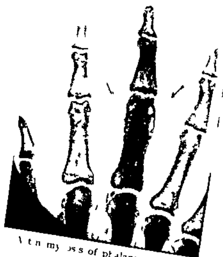
The physical signs of pleural effusion or lung-consolidation may accompany many pulmonary diseases, but the finding of the fungus in an effusion or in the pus from an empyema or abscess enables one to make a definite diagnosis.

Malignant disease of the lung or mediastinum may give similar X-ray appearances, but with malignant disease one is more likely to find a serous or sanguineous effusion in the pleural cavity.

The one golden rule for the practitioner is always to consider the possibility of actinomycosis in any doubtful thoracic condition.

ACTINOMYCOSIS OF BONE WITH SPECIAL REFERENCE TO VERTEBRAL INVOLVEMENT

Actinomycosis of bone nearly always results from infection by contiguity. Less than a dozen cases of infection by metastasis have been reported, so that



Fi ... Actinomycosis of phalanx (An ...)

actinomycosis of the long bones of the limbs and the small bones of the foot are clinical curiosities. The accompanying illustration (Fig. 25) shows the involvement of a phalanx of a finger which had been bitten; the infection must have been conveyed directly from the teeth of the assailant.

We have described elsewhere how the mandible may be affected in cases of cervico-facial actinomycosis. The

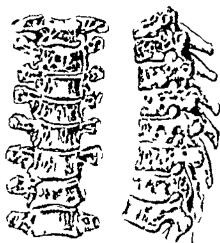


Fig. [illegible] Effect of actinomycosis on the vertebrae [illegible] (from Poncet and Bérard [illegible] 1898, after Bostrom)

other part of the skeleton which is quite frequently involved in the disease is the **vertebral column**.

Vertebral actinomycosis may result from an extension of the disease either in the thorax or in the abdominal cavity. In the thorax mediastinal infection often involves the adjacent thoracic vertebral bodies and the adjoining parts of the ribs. In the abdomen the lumbar vertebral bodies are affected by extension from a retro-peritoneal infection spreading from an ileo-caecal focus.

The vertebral column is affected in a way quite different from that in any other form of infection. The process commonly affects the bodies and transverse process but it may invade any part with which it may come in contact. There is a very slow process of absorption and a simultaneous formation of new bone which as a rule is enough to maintain the framework and strength of



Fig 2 Actinomycosis of lumbar spine (Clarke)

the vertebral bodies so that collapse of a vertebra is rarely seen and is seldom so extensive as in tuberculosis. The intervertebral discs are involved late or not at all and they do not disintegrate as in tuberculosis. The disease may surround the exits of the nerves and cause severe pain but it is rare for the fungus to penetrate the dura though occasionally pressure on the spinal cord may cause paraplegia.

In the earliest stage the X rays show little change in *the bone* but later the appearance may be almost pathognomonic for the areas of absorption and newly formed bone form a pattern on the radiograph which is not seen in any other vertebral condition the side view *of the bodies gives the impression of a lattice work or* a coarse sieve When the condition is being successfully treated successive radiographs show some increase in density of the formerly rarefied areas

Diagnosis of vertebral actinomycosis is *difficult for* there are no pathognomonic signs or symptoms If however a definite diagnosis has been made of ileo cecal actinomycosis the observer should always bear in mind the possibility of involvement of the vertebral bodies If, in such a case radiological changes are demonstrated in the vertebral bodies one can confidently make the diagnosis of vertebral involvement particularly if the peculiar lattice pattern is observed in the bone

ACTINOMYCOSIS OF THE CENTRAL NERVOUS SYSTEM

The central nervous system is so well protected by the skull and vertebral column that it is comparatively seldom attacked by actinomycosis Nevertheless facial actinomycosis sometimes travels upward and may enter the skull through one of the basal foramina and cause meningitis or the disease may *(rarely) enter* the spinal canal via the intervertebral foramina and still more rarely may penetrate the dura Moreover metastatic actinomycosis of the central nervous system may take the form either of a cerebral abscess or of a diffuse cerebro spinal meningitis

There is in addition a very rare cerebral lesion which deserves description on account of its intrinsic interest and because of its likely route of infection the so called

isolated actinomycosis of the brain Only ten cases of this description have been recorded and of these six presented a circumscribed actinomycotic granuloma in the region of the septum lucidum It is likely that in the patients who suffered from this curiously situated lesion the infection may have travelled up into that region



FIG 28 Solitary actinomycosis of the brain (Sternber)

via the olfactory nerve sheaths from the upper part of the nasal cavity In these cases the granuloma varied in size from a walnut to a cherry was rounded in shape and composed of a gelatinous greyish yellow material The granules of the fungus were not visible to the naked eye but were identified on microscopical examination

Metastatic abscesses in the brain are not uncommon and affect the left more than the right cerebral hemisphere The symptoms do not differ from those of abscesses

due to other organisms the infection usually has its origin in the lungs

Metastatic actinomycotic meningitis may take its start in the brain or spinal canal sometimes there is a superimposed secondary infection but pure actino

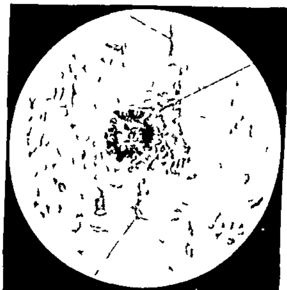


Fig 29 Actinomycosis of the spinal cord (Wegelin)

mycotic meningitis may occur Wegelin recorded the case of a man who died of a pure actinomycotic meningitis which arose metastatically from a pulmonary lesion a remarkable point in the case was the finding of an actinomycotic focus in the lumbar part of the spinal cord (see accompanying illustration)

PRIMARY ACTINOMYCOSIS OF THE SKIN

Primary actinomycosis of the skin may follow infection through an abrasion or possibly in some instances along the duct of one or other of the cutaneous glands

The picture is that of a slowly growing granuloma with little tendency to spontaneous healing The surface of the lesion at first smooth may become irregular by softening or sinus formation An important point to remember and one which has been insisted upon by many writers is that the condition seems unusual and resembles nothing commonly seen The resemblance to

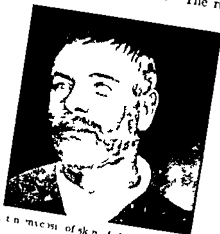


Fig 3 Actinomycosis of skin of cheek (Author's patient)

other chronic lesions may be close but is not perfect The only sure method of diagnosis is to find the actinomyces in the discharge

Differential diagnosis has to be made from a boil carbuncle gumma lupus lupus erythematous and epithelioma of the skin Mistakes in diagnosis will not occur if the condition is borne in mind and the discharge duly examined for the actinomyces

Secondary actinomycosis of the skin is very common and occurs as deep foci work their way to the surface of the body

material for pathological examination may become available Furthermore secondary infection may confuse the issue Even the removal of a small portion of tissue for microscopical examination may not always settle the diagnosis for it may be necessary to examine many sections before a typical element of the fungus be found The agglutination and other blood tests are of little diagnostic value

Diagnosis has to be made from other forms of chronic inflammation and from the various malignant and simple neoplasms

The soft type may simulate septic syphilitic or tuberculous inflammation the indurative type more often resembles a neoplasm

Purely septic lesions are usually more acute and painful and they commonly cause enlargement of the neighbouring lymph glands Though actinomycosis is not often ushered in with acute symptoms there do occur exceptional cases in which the onset is acute and in such cases diagnosis will be impossible without careful examination of the pus

Actinomycosis should always be considered in the diagnosis of any swelling near the lower jaw or any inflammatory condition of the neck

DIAGNOSIS OF VISCERAL ACTINOMYCOSIS

Visceral actinomycosis has in the past often been misdiagnosed during life and only discovered at autopsy One of the main reasons for writing this little account of the disease is to help towards the diagnosis of visceral actinomycosis during life for now it is possible to cure most of these cases

It would require a small text book to enumerate the symptoms which may be caused by visceral actinomycosis but in the early stage of the disease there i

little or nothing characteristic. Irregular fever is the rule and there is moderate leucocytosis. Whenever the condition has existed for some weeks there will be increasing anaemia, lowered serum protein, wasting and loss of strength. Pain may be absent, but if nerves are irritated, as in some cases of vertebral actinomycosis, there may be considerable pain.

The local symptoms vary greatly according to the part affected. In the ABDOMEN there is usually the formation of a hard swelling, usually painless to pressure and as a rule fixed. This swelling is significant when it surrounds the sinus left after drainage of an appendicular peritonitis, for this is the commonest occasion for the development of abdominal actinomycosis.

When a hard actinomycotic mass develops in the pelvis or around the colon it is almost always taken for a malignant growth, though it is rare for true acute intestinal obstruction to occur.

In the LIVER the disease may take the form of one or more tumour-like masses, or it may invade a large portion of one of the lobes and form numerous abscesses which disintegrate the glandular substance. The X-rays may show the liver enlarged upwards and an abscess sometimes bursts through the diaphragm into the lung, or a subphrenic abscess may form.

I have known at least two cases in which fairly small localized masses in the liver were impossible of diagnosis until a portion of the mass had been removed for biopsy.

DIAGNOSIS OF THORACIC ACTINOMYCOSIS

Thoracic actinomycosis is very seldom diagnosed until a late stage of the disease. In the earlier stages it is usually thought to be tuberculosis, pneumonitis, pleural effusion, empyema or malignant growth. When it invades the mediastinum it may closely simulate a mass of

glands or when the vertebræ are involved it may resemble osteomyelitis or give rise to meningeal symptoms

In the thorax actinomycosis always (if the patient lives *long enough) comes to the surface in the form of an* abscess The mediastinal abscesses point to one or other side of the vertebral column in the upper or lower dorsal region When the pulmonary tissue is the site of the disease the empyema which forms comes to the surface by infiltrating the thoracic wall anteriorly or laterally at about the level of the attachment of the diaphragm

Tuberculosis of the lungs unlike actinomycosis never causes a superficial thoracic abscess The dorsal abscess which tracks back from an actinomycotic focus in the vertebræ or mediastinum differs from the cold abscess resulting from caries of the spine in that it is generally painful causes redness and œdema of the skin and adjacent parts and contains a thicker pus from which actinomycotic granules can be obtained

Patients suffering from visceral actinomycosis of long standing may develop amyloid disease one of the first indications of which may be albuminuria the observer should therefore remember to think of actinomycosis as a possible cause of this serious condition

PROGNOSIS OF ACTINOMYCOSIS

Most cases in the head and neck get well
Though the duration one can never foretell
And in the viscera I m glad to say
The outlook is more promising to-day
For penicillin has brought hope and transformed the
prognosis
Of those who have this deadly form of actinomycosis

Cervico facial actinomycosis has always been of good prognosis but until recently visceral actinomycosis gave

measures be contemplated before the general strength has been built up.

DRUG TREATMENT

Of the drugs formerly recommended iodine and its derivatives are still of some value in promoting absorption of inflammatory products, but the practitioner should know that potassium iodide is *not* a specific cure for actinomycosis and that the use of large doses of this drug, still recommended and practised by some, is both unnecessary and wasteful, besides being rather unpleasant for the patient. (Potassium iodide *is* a specific cure for actino-bacillosis which causes the wooden tongue in cattle.) If iodine is to be administered for actinomycosis—and it is a useful adjuvant—it should be in the form recommended by Chitty, who in 1929 advised giving *5 minims (0.3 ml.) of tincture of iodine in a glass of milk* thrice daily. By this means Chitty cured several severe cases of visceral actinomycosis.

The iodine derivatives ofttimes may do some good
Although one cannot say before how great the
likelihood
But please recall that Pot. Iod. is not a true specific
And there is not the slightest need for doses so terrific
As those advised in former days—it was a useless
waste
And also to the patient gave a most unpleasant taste.

If iodine be given it does truly seem a pity
So few practitioners yet use the simple way of Chitty
Who gave Tinctura Iodi five minims thrice a day
Commingled with a glass of milk—a very pleasant
way.

As stated above, the drugs which are of most use in the treatment of actinomycosis are the sulphonamide group and the powerful antibiotic penicillin. In

addition some of the other anti biotics such as streptomycin and aureomycin are of value

It has been shown that sulphanilamide sulphathiazole and sulphadiazine have a definite inhibiting effect on the actinomyces *in vitro* and sulphamerazine has been proved clinically to have a curative effect It may be that many others of the same group may act similarly These drugs may be given in doses of 1 gm every six or eight hours continued for several weeks Care should be taken to see that no agranulocytosis results if the leucocyte count indicates any tendency to this the drug should be stopped at once

At the present time **Penicillin** is the sheet anchor in the treatment of actinomycosis The most desperate cases have been saved by this truly wonderful anti biotic When first it began to be used in the treatment of actinomycosis the doses given were quite inadequate and were continued for too short a time improvement certainly occurred but the condition relapsed as soon as the drug was discontinued

At first 100 000 units a day were thought adequate later 500 000 units were recommended and now most of those experienced in treating actinomycosis by this drug would recommend at least one million units daily Some give as much as two million units daily

There are two rules to be obeyed in treating actinomycosis by penicillin The first is that there should be no intermission in the treatment The second is that the treatment must be continued not only until the symptoms have subsided and the signs disappeared but for some week after the patient seems to be perfectly well Only thus will relapse be prevented These rules apply particularly to visceral actinomycosis

Treatment by three hourly injections is tedious and unnecessary and the intravenous method of administra

tion is not so convenient as hypodermic or intramuscular injection

The most suitable method is to administer 500 000 units in concentrated form intramuscularly twice in the twenty four hours The most suitable places for the injection are the outer part of one or other thigh the upper part of the buttock or the lax tissues of the loin

Inasmuch as the injections may have to be continued for months with great inconvenience to the practitioner



Fig 31 Showing the effect of treatment of pulmonary actinomycosis by penicillin (Case under the care of M T [illegible])

it may sometimes be possible to train an intelligent patient to give himself the injections The outer aspect of the thighs serves as a good place for the injection (I gave this suggestion to Mr W G Gill who in a prolonged case trained his patient to give himself the injection and achieved a successful result)

When the response to penicillin is slow or absent (and it is known that occasionally penicillin resistant strains of the actinomyces do occur) there may be some advantage in combining treatment by penicillin with a course of one or other of the sulphanilamide group and

some observers claim better results by this combination of drugs. Penicillin may also be given by inhalation. An alternative to penicillin is streptomycin which can be given in doses of 1 or 2 gm daily for as long as one month; the drug is given as a rule parenterally but it cannot safely be given for such long periods as penicillin. Chloramphenicol has also been tried with success.

So nowadays there is no need to treat with iodine,
Far better are the sulpha drugs—as sulphadiazine—
Which benefit and sometimes cure this obstinate disease,
Yet these will ofttimes fail to cure as one too often sees.

The best of all medicaments—your list of drugs to fill in—
Is that great wonder working mould—the famous penicillin
Which if you give for long enough and in sufficient doses
Makes almost every hopeless case of truly good prognosis.

SURGERY IN ACTINOMYCOSIS

What place has the operating surgeon in the treatment of actinomycosis? The answer is that surgery has a diminishing part in treatment. Abscesses must be opened or if small they may be aspirated. When the surgeon meets with a massive lesion of the stomach, intestine or kidney he may think it necessary to excise the diseased part. It is not necessary to excise pulmonary lesions nor to remove the large masses of fibrous tissue which form in many instances within the abdomen or

elsewhere A cerebral abscess will require to be opened or excised

THE PREVENTION OF ACTINOMYCOSIS

By careful prophylaxis it should be possible almost to abolish human actinomycosis The common site of latent infection is the carious tooth so that the proper care of the teeth should greatly lessen the incidence of the disease The prevention of actinomycosis therefore lies largely in the hands of the dentist

PROPHYLAXIS

If Lord and Naeslund be assumed correct
(As yet by no one is their work suspect)
Then actinomycosis will just vanish
If dental caries you entirely banish
Let dental hygiene then be well obeyed
(Not lip attention only should be paid)
In everyone whatever be their age
Treat dental caries at an early stage
And when a septic tooth *must* be extracted
Let this most rigid rule be full enacted
Give penicillin as a sort of shield
To stop infection in the septic field

A Case of Actinomycosis which affected all Three Cavities of the Body in turn Abdomen Thorax and Cranium

The most instructive case of actinomycosis which I have ever seen was that of a patient who suffered in turn from *an actinomycotic affection of the sigmoid colon* of the liver of both lungs and finally of the brain This patient made a recovery sufficient to enable him to carry on his business as a merchant

The patient was of Greek nationality and carried on his business in Athens as a wholesale cloth merchant

He was in the early forties. In 1945 he developed an abdominal swelling and consulted a surgeon who suspected a malignant growth and advised abdominal exploration. At the operation a large hard mass was found in the lower abdomen in close relation to the sigmoid colon. The mass was fixed to the surrounding parts and the surgeon considered that his diagnosis of malignant growth was confirmed and that the tumour was not removable. The abdomen was therefore closed and the patient was advised to come to England for radiation treatment of the growth. In England he was under the general care of Dr Cawadias. The diagnosis made in Athens was at first considered as most likely correct and arrangements were made for treatment by the X rays but soon a sinus developed in the line of the medial scar and pus discharged which contained actinomycotic granules. At this stage he was admitted under the care of the writer.

When admitted on August 8th 1945 the patient was in fair general condition. In the lower abdomen chiefly to the left of the middle line was a large hard mass fixed to the anterior abdominal wall and to the deeper structures. There was a discharging sinus in the mid line scar and another in the left groin. From the pus obtained from the mid line sinus the actinomyces and the *Bacillus pyocyaneus* were obtained.

On the day after admission treatment by penicillin was begun. At first a continuous intravenous drip was instituted so that the patient received 200 000 units a day. A few days later the drip was stopped and three hourly injections of 30 000 units of penicillin were started. Within a fortnight the hard swelling had decreased to about half its former size.

On August 21st the liver was found to be enlarged and an X ray photograph showed that the right dome of the

diaphragm was raised and that there was a small pleural effusion and some compression of the peripheral lower lobe of the right lung Five days later the signs of basal consolidation were increased About this time a small fecal fistula developed through the median sinu this wa of large bowel type and seemed to show that the actinomycotic lesion was in connection with the sigmoid colon

During the month of September the penicillin wa continued and the abdominal swelling diminished till it was only a quarter of its original size but the liver remained large the right dome of the diaphragm remained immobile and it was feared that an abscess might burst into the lung

On October 8th the patient began to cough up pu and a day or two later great respiratory distress developed respirations went up to 36 per minute and there was an increase in the basal consolidation of the right lung *The pulmonary condition grew still worse and on October* 27th there was a spreading parenchymatous inflammatory condition involving all zones of both lungs indicating a bilateral broncho pneumonia At this time the patient condition was very critical and remained so for a week or two

To counter this new complication increased amounts of penicillin were given A quarter of a million unit were given twice daily by injection and in addition penicillin inhalations were administered Large amount of pus were coughed up and it was clear that a large hepatic abscess had burst into the lung At first th pu did not yield the actinomyces but later on the fungu was *detected in the material coughed up from th* lung

The increased doses of penicillin caused the complet disappearance of the abdominal swelling and the clear

of both sinuses The pulmonary condition gradually became less acute but bilateral bronchiectasis developed and was demonstrated by the X rays

It was several months before the general condition of the patient improved sufficiently for him to travel back to Athens and he was recommended to continue the inhalations of penicillin daily Considerable sputum containing actinomyces continued to be coughed up

A few weeks after he had returned to Athens the patient had a Jacksonian fit indicating the likelihood of a cerebral complication He was promptly flown back to England and admitted to the Radcliffe Infirmary Oxford under the care of Sir Hugh Cairns who diagnosed a left cerebral abscess in the fronto-parietal region Operation confirmed the diagnosis and Sir Hugh was able to excise completely an abscess in the region indicated A good recovery followed though slight weakness of the right arm remained The abscess was found to contain only diphtheroid bacilli but in view of the enormous amounts of penicillin which had been given it is reasonable to conclude that any metastatic actinomyces had been destroyed

The patient was able to return to Athens where he is now able to follow his former business duties

This case well illustrates the methods of spread the difficulties in diagnosis and the success of the penicillin treatment even in desperate cases of actinomycosis

Actinomycosis of the Spine with Generalized Œdema and Ascites Recovery from the Actinomycotic Infection but Death from Amyloid Disease of the Kidneys

W McN by trade part carpenter part fisherman in the autumn of 1944 when he was 37 years old first noted a dull aching pain in the right shoulder In May 1945 he had backache and some shortness of breath and a

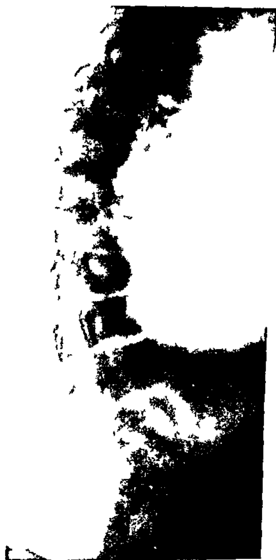


Fig. 32

swelling appeared at the back between the shoulders. An abscess was opened and a short course of penicillin given though no specific microbe was found in the pus.

A radiograph showed some evidence of infective bone changes in the bodies of the third and fourth thoracic vertebræ.

During 1945, 1946, 1947 fresh abscesses kept appearing in the back and though he worked from time to time he lost weight, felt weak and developed slight kyphosis. From January to March 1948 he was treated in hospital by two short courses of penicillin (three million and five million units respectively) and the sinuses healed but no specific organisms were found.

In May 1949 his ankles swelled and there was pain and stiffness in the left hip and he was troubled by intermittent attacks of diarrhœa. At this time he was admitted to St Mary's Hospital under the care of Mr Dickson Wright by whose kindness the writer was enabled to see the patient.

When admitted he looked very ill, was anæmic and had pale puffy features and there was generalized œdema. His weight was 9 st. 2 lb. He walked with a limp and could not stand erect because of 80° of flexion of the left hip joint. On the back, the left side of the neck and right side of the chest there were many sinuses showing bluish granulations. There was kyphosis of the dorsal spine and rigidity of the lumbar spine. The liver and spleen were not palpable but there was gross ascites.

The X-rays showed that from the level of the fourth thoracic to the first lumbar vertebral body all the vertebral bodies showed areas of rarefaction and of new bone formation; there was some loss of intervertebral disc space and a cavity in the upper posterior part of the body of the first lumbar vertebral body.

Sulphur yellow granules were found in the pus and the actinomyces were grown anaerobically and found to be extremely sensitive *in vitro* to penicillin and streptomycin

When the diagnosis was clear penicillin was given in doses of half a million units twice daily by intramuscular injection from June to November—a total of 140 million units He was put on a low salt diet with high protein content and was given a transfusion of two pints of blood

Within fourteen days the pain in the back (which had been continuous for four years) had entirely disappeared and the left hip could be moved through its full range of movement without pain and the sinuses had dried up By August 10th the oedema (except in the ankles) had disappeared but the ascites persisted There was an almost complete range of painless spinal movement A three weeks course of streptomycin was then given (0 5 mg twice daily intramuscularly)

The patient returned to work in November 1949 He had another course of penicillin injection from March to June 1950 (total of 80 million units) By August 1950 he was able to do a full day s work as a farm man without symptoms and could row for long periods without fatigue When seen in February 1951 he remained well though there was still some albuminuria The X ray of the spine showed that the disease of the vertebral bodies had been arrested

This patient appeared to be cured but returned a few months later with renal disease and suppression of urine from which he died At the autopsy there was no trace of actinomycosis but there was amyloid disease of the kidneys which was the cause of the fatal issue The story of the patient emphasizes the importance of early and vigorous treatment of visceral actinomycosis so as to avoid the onset of amyloid disease

AFTERTHOUGHT

What is written above for the most part suffices
For the G P to know of the actinomyces
Of these clinical facts if he care to be master
He will shun many troubles and maybe disaster
But if of this knowledge he still be deficient
Then—surely a word to the wise is sufficient

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